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ABSTRACT

In spring 1983, a study was commissioned by Milwaukee Area Technical College (MATC) to identify the skills that would be needed by local businesses and industries within the next 5 to 7 years due to technological changes. Interviews were conducted with 25 deans, associate deans, and instructors at MATC and with representatives from 39 area firms. Industry representatives, including 39 personnel/human resources vice-presidents and 115 individuals with knowledge of the day-to-day operations and planned or projected changes in the companies, were asked about recent changes in the knowledge and skills necessary to job performance, existing skill deficiencies in current employees or job applicants, and new skills and jobs that would be required in the future. Findings, which were organized to correspond to MATC curricula, included the following: (1) future needs were difficult for the respondents to project due to rapidly changing technology; (2) firms were often dissatisfied with the basic educational skills of prospective employees; (3) computer skills were felt to be essential to occupations in mechanical drafting, metallurgy, technical engineering, tool and die making, electromechanical technology/hydraulics-pneumatics, industrial engineering, data processing, and business administration; and (4) two-year college graduates in the fields of nursing and business administration were expected to face increasing competition from four-year graduates. (LAL)

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ED235869

FUTURE SKILL NEEDS ASSESSMENT OF SELECTED METROPOLITAN MILWAUKEE BUSINESS AND INDUSTRY

PREPARED FOR
THE ECONOMIC DEVELOPMENT DIVISION
MILWAUKEE AREA TECHNICAL COLLEGE

PREPARED BY

HUMAN RESOURCE SERVICES
MAY 1983

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JC 830 499

Human
Resource Services

May 27, 1983

Dr. Rus F. Slicker
District Director
Milwaukee Area Technical College
1015 N. Sixth Street
Milwaukee, Wisconsin 53203

Dear Dr. Slicker:

I am pleased to transmit to you the results of Human Resource Services' recent study for the MATC Division of Economic Development.

This Future Skill Needs Assessment presents information gathered from 39 metropolitan area firms involving a diverse spectrum of manufacturing and non-manufacturing environments. The results are based on interviews with over 150 executive, managerial and technical personnel within those firms. The data summarizes these individuals' perceptions regarding technical knowledges and skills which are emerging as crucial to their companies. The findings provide MATC with direct feedback from the businesses who participated in this effort.

I would like to indicate to you the exceptional cooperation received from the firms we contacted. Their willingness to make key individuals within their operations available for interviewing was critical to the successful completion of this project.

HRS is confident that this study will be of use to MATC in its ongoing efforts to respond to the needs of Milwaukee's business community.

Sincerely,

David J Potts

David J. Potts
President
Human Resource Services

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TABLE OF CONTENTS

I. NATURE OF THE STUDY 1

II. OVERVIEW 3

III. BACKGROUND 5

IV. STATUS OF HUMAN RESOURCE PLANNING EFFORTS 9

- DEMAND
- SUPPLY
- COOPERATIVE EFFORTS

V. APPROACH TO THE STUDY 11

- TIMEFRAME
- SCOPE
- ASSUMPTIONS

VI. OVERVIEW OF METHODOLOGY 15

- SAMPLING
- INTERVIEWING

VII. SUMMARY OF FINDINGS 22

- ORGANIZATION OF FINDINGS SECTIONS

A. DRAFTING/ENG.TECH/MECH.DESIGN 24
B. TOOL AND DIE/MACHINISTS/NC 30
C. ELECTROMECHANICAL TECHNOLOGY / HYDRAULICS - PNEUMATICS 34
D. INDUSTRIAL ENGINEERING TECH 37
E. METALLURGY 40
F. BUSINESS DATA PROCESSING 42
G. BUSINESS ADMINISTRATION 47
1. ACCOUNTING
2. BANKING AND FINANCE
3. MANAGEMENT
H. PRINTING AND PUBLISHING 51
I. HEALTH OCCUPATIONS 53
1. BIOMEDICAL ELECTRONICS
2. RADIOLOGICAL TECHNOLOGY
3. RESPIRATORY THERAPY
4. OPERATING ROOM ASSISTANT
5. NURSING
a. REGISTERED
b. PRACTICAL
J. INDUSTRIAL ELECTRONICS 57

VIII. CONCLUSION AND RECOMMENDATIONS 61

A. EMPLOYER NEEDS
B. MANDATE TO CITIZENS
C. HUMAN RESOURCE DEVELOPMENT PLANNING

IX. CONCLUDING IMPRESSION 70

APPENDIXES

A. SOURCE DOCUMENTS 72
B. SERVICES/TRADE OCCUPATIONAL GROUPS 74
C. TITLES OF INTERVIEW PARTICIPANTS 76
D. TECHNICAL JOB TITLES SAMPLED 78
E. COMPANIES SAMPLED 80

ACKNOWLEDGMENTS

I. NATURE OF THE PROJECT

This project was commissioned by the Economic Development Division of the Milwaukee Area Technical College. The primary goal of the study was to assess the future workforce skill needs of metropolitan Milwaukee business and industry, particularly skill needs relating to technological change.

In 1980 MATC established an Economic Development Division to further emphasize its ongoing partnership with Milwaukee business and industry. That Division acts as the primary communications link between MATC and the executives of area firms. The major responsibility of the Division is to identify ways in which MATC can best assist local business and industry, particularly in any growth or expansion efforts.

The Division is also charged with attempting to create a climate that will encourage economic growth with both new and existing businesses. Over the last several years the Division's primary activities have been directed at working with MATC's instructional divisions on curriculum modifications necessary to meet the current skill needs of area companies.

In February 1983, the Economic Development Division began a project that was designed to be the first phase of a strategic planning process for MATC educational policy and curriculum development through the late 1980's. Human Resource Services (HRS) was retained to undertake a preliminary analysis of skills that will be needed by metropolitan area business and industry through the latter part of this decade. MATC indicated that it felt such a long term planning effort was crucial to its ability to assume a proactive role in the economic viability and growth of this community.

HRS was also asked to examine the need for a comprehensive approach to human resource development planning as a component of MATC's overall economic development strategy. The metropolitan area currently has an 11.2% unemployment rate and recent analyses have indicated the potential for increased levels of structural unemployment in the remainder of the decade, due to significant shifts occurring in the area's traditional economic mix. As the major technical training institution in the region, MATC would have to play a key role

in any attempt to upgrade the skills of the area's workforce to meet the changing skill needs of local business and industry.

From the onset MATC and HRS realized the complex nature of this project. A major question raised in the planning stage regarded the willingness of the business community to support such a "futuristic" effort during a time of severe recessionary impact. Many area companies are in the midst of major long term layoffs and a number of firms are on an almost day-to-day survival footing. Because of this, it was essential that firms being asked to cooperate in the project clearly understood the potential benefits they could gain from participating.

MATC District Director Rus Slicker addressed that issue directly in his letter to the CEO's and Presidents of area companies contacted about the project:

> MATC is currently involved in a strategic planning process to allow us to better anticipate future workforce skill needs, particularly those which may arise out of technological change. . . .
>
> We fully realize that any attempt to identify the "what might be world" of the end of this decade is fraught with problems and unknowns. However, we are determined to undertake this project because we feel that building a stronger joint planning effort. . . is a key part of our role in providing you with people who possess the skills necessary for your company to maintain a productive workforce. . . .
>
> It is essential, both to our commitment to you and our mandate, to provide the citizens of this community with current, marketable and competitive job skills.

II. OVERVIEW

The metropolitan Milwaukee area (a 1.4 million population SMSA consisting of Milwaukee, Ozaukee, Washington and Waukesha counties) has a non-agricultural workforce of 632,600. The SMSA contains more than 28,000 businesses. There are approximately 8500 service firms, 7200 retailers, 2700 manufacturers and 2600 wholesalers.

The 1980 Census Data indicated that the service sector represented 22% of total employment and the wholesale and retail trade sectors employed 21% of the total workforce. Almost 32% of the SMSA labor force was employed in manufacturing industries. (The 1982 manufacturing figure was 27.3%.) A major portion of those industries were engaged in durable goods production.

Annual production of more than $9 billion worth of manufactured goods is complemented by some $15 billion in annual wholesale business and annual retail sales of nearly $6 billion.

Traditionally, one of Milwaukee's strongest attractions for industrial location and expansion has been its reputation for possessing a highly skilled and productive labor force. This labor force is in large part produced by an extensive educational network consisting of some 140 junior and senior high schools, nine colleges and universities, six technical and/or junior colleges and a wide range of professional schools and institutes.

The movement (growth, decline, diversification, outmigration, etc.) of Milwaukee's economy over the remainder of this decade will be a function of many varied (and in some instances unforeseen) demographic, political, sociological and economic factors.

Recent studies involving economic growth projections for both Wisconsin, as a whole, and Milwaukee, specifically, have indicated the metropolitan Milwaukee area has a high reliance on industries which may require significant modifications in manufacturing techniques and productivity to stay economically competitive. Statistics indicate that as these changes have begun to take place, a "skills mismatch" between workers and available job opportunities is occurring. This situation will continue and is likely to significantly worsen over the next ten years. This will be particularly true in industries where technological changes affect

current production methods and/or create new production techniques. A parallel, if somewhat less dramatic, shift will also occur in the service and retail sectors.

Those studies, implicitly and explicitly, raise serious questions about the need to design and implement more systematic approaches to labor market planning. Without such planned intervention it appears highly probable that the Milwaukee area faces the potential of severe labor market dysfunction by the end of this decade, characterized by higher and higher levels of structural unemployment and an increased inability of the metropolitan area to retain existing industry and/or attract new industry.

The economic factors that could lead to such a level of labor market dysfunction are rooted in trends in Wisconsin's overall industrial mix that have occurred over a period of years. The following section highlights some of those trends.

III. BACKGROUND

Within the last three years, at least six studies concerning Wisconsin's economic growth and employment trends through the 1990's have been published. (See Appendix A.) These reports vary widely in terms of economic assumptions, levels of sophistication and statistical differentiation, and taxonomies used. Several were major research documents utilizing complex econometric modeling techniques, while several others used simple statistical extrapolations.

Although widely divergent in both methodology and format, these reports all contain descriptive and predictive data on Wisconsin's industrial or occupational mix through the remainder of this decade. Due to differences in economic assumptions and focus, these reports contain somewhat conflicting statistical projections concerning various economic sectors and specific industries. There are, however, certain issues and trends on which there is relatively fundamental agreement across all the reports. For instance:

-- Wisconsin currently has a higher than national average reliance on manufacturing jobs;

-- Manufacturing represents 28.8% of total Wisconsin non-agricultural employment (the figure is 32% for the Milwaukee SMSA), while trade represents 22.6% and services (non-governmental) represents 18.8%.

-- Wisconsin's manufacturing sector has shifted from one of mostly strengths to one of mixed advantage and significant limitations to its future growth.

-- Between 1979 and 1981 Wisconsin lost 43,200 manufacturing jobs. This is more than double the national average loss. At least 25% of that decline cannot be explained by national recessionary trends (i.e., this represents a potential permanent loss of some 10,000-plus manufacturing jobs.)

-- Ranges for projected growth through 1990 indicate manufacturing jobs will grow between 9.5% and 19.1% while service will increase between 30% and 41.3% and trade jobs between 20.8% and 30.6%.

Future Skill Needs Assessment

-- Wisconsin's current and future employment growth is adversely affected by having a smaller than average national share of high technology industries (less than one-third of what would represent a proportionate share of the U.S. high technology employment base.)

-- Because manufacturing is the state's largest basic industry, growth in the non-basic service and trade industries depends significantly upon income and economic activity generated by manufacturing. The exception to this would be exportable - to regional or national markets - service and trade industries.

There is a second area of strong agreement throughout these reports. It relates to the critical role a skilled and quality labor force will play in the economic planning and strategies necessary to address the issues and trends outlined above.

The following listing of comments regarding the importance of a skilled labor force was excerpted from several of the reports:

From WISCONSIN MANUFACTURING: CHARTING A COURSE FOR RENEWED VITALITY. Department of Development (DOD). (All volumes):

-- Wisconsin executives and non-Wisconsin industrial developers identified labor availability and productivity along with the state's Voc-Tech Education system as major strengths in Wisconsin's business climate;

-- A primary policy goal (for DOD) is to improve the relative growth of Wisconsin establishments in industries with national growth potential that have historically grown less rapidly in Wisconsin. "To achieve this objective, it is vital to remove barriers to development of these industries. . . . Labor oriented policies specifically those increasing skilled labor availability and quality are of the utmost priority;"

-- "Labor policies are a top priority (vis-a-vis retaining and expanding the market share in a currently strong industry such as non-electrical machinery) especially as they pertain to training a workforce adept at handling more technologically advanced equipment;"

Future Skill Needs Assessment

-- Encouraging the location and growth of high technology industries in Wisconsin "is a key development need for the 1980's." (A recent study on high technology industry by the Congressional Joint Economic Committee urged that the top priority for high technology companies in making inter-and intra-regional location decisions is "high skilled technical labor and cost;"

-- According to surveys conducted by DOD with CEO's of Wisconsin companies, "shortages of high skilled technical workers in Wisconsin impede existing high technology growth in the state."

- - -

From WISCONSIN INDUSTRY PROJECTIONS TO 1990. DILHR:

-- "Without appropriate training there will be a labor shortage in many fields by 1990. If Wisconsin industry and business cannot find workers able to handle the jobs (they) will not be able to compete. . . ."

-- "Wisconsin business and industry will face a severe labor shortage in most skill areas (by the 1990's). If planning and training for the future is not undertaken, economic growth could be stymied."

- - -

According to a study released in 1981 by the Metropolitan Milwaukee Association of Commerce's Skilled Labor Task Force:

-- "Milwaukee's strong industrial base will be threatened unless a much larger pool of skilled workers becomes available. . . ."

- - -

Obviously, a number of factors both labor related (such as wage scales, U.C., worker's compensation costs, etc.) and non-labor (such as taxation, regulatory climate, infrastructure, etc.) impact on locational decisions of corporations. In many instances the primary factors are industry specific. However, regardless of the particular industry's priority, at some point in the decision, labor availability must be considered - the company must have a workforce. Given some of Wisconsin's other po-

tential drawbacks concerning industrial location it seems patently clear that it can ill afford to lose its reputation for providing a skilled and productive labor force.

According to DOD, "Labor availability is a key factor for all the industry groups (identified in their study.) As such, it is the key component of the development strategy adopted by DOD."

The intent of this study was to identify the skills that representatives of a selected group of metropolitan Milwaukee business and industry viewed as becoming crucial for their workforce within the next five to seven years due to technological change.

IV. STATUS OF HUMAN RESOURCE PLANNING EFFORTS

The issue that arises is how a local labor market, such as metropolitan Milwaukee, can best address the issue of "skill" shortages. The data provided in Section III indicates that concerted action must be taken to provide local industry and business with the trained personnel they need to adapt to coming technological changes and developments. The strong emphasis placed on workforce quality by these reports reinforces the crucial role Wisconsin's educational system, and particularly the VTAE system, plays on the supply side of the local labor market.

Furthermore, if "human capital" is to be used as part of an economic development plan to attract or recruit new growth industries, then there must be a clear understanding of the specific skills with which that human capital is to be provided. Certainly, individuals faced with potential unemployment and economic dislocation will want a clear idea of the options open to them for learning new skills.

To prevent the kind of labor market dysfunction and skill mismatch which is predicted by the data presented in Section III, a community needs to have an ongoing human resource planning function in operation. Such a planning process would involve a feed-back and evaluation system between the business and educational communities, as well as appropriate economic development officials in both the public and private section.

A question that would be appropriate to ask at this point is, are there currently planning processes in place on either the demand side (business/industry) or on the supply side (education/training institutions) of the labor market which could help in the design of a systematic approach to the current problems?

Demand: Most large companies engage in strategic planning through identifying declining or rising markets and determining how to improve their market share and profitability. However, many large and otherwise sophisticated companies do not engage in manpower forecasting or comprehensive human resource planning. Those companies which do so focus primarily on managerial and executive personnel.

Future Skill Needs Assessment

In many instances, a new piece of equipment or technology itself defines the set of skills necessary and it is extremely difficult to anticipate them until it is installed and operating. As a result, variations in labor supply have frequently been met with unplanned or ad hoc policies designed to overcome immediate skill shortages. This approach is clearly inadequate in the rapidly changing technological environment of the 1980's.

Supply: Educational and training institutions traditionally have been viewed as reactive rather than proactive. Because industry controls the job or task analysis data regarding new skills, it has primarily been on their request that new courses, curriculum changes or on-site training programs have been developed.

However, particularly since the late 1970's, educational institutions have taken a more aggressive role in initiating contact with industry and soliciting or suggesting specific programs. That type of activity has become essential to the ability of such institutions to be responsive to changing needs.

Cooperative Efforts: A number of cooperative efforts including the use of business/industry representatives on curriculum advisory committees, industry internships for teachers and instructors, and student work programs are currently in place. Given the accelerated pace of the changes occurring in business and industry, it seems unlikely that those efforts are adequate to provide enough lead time for necessary educational policy and program shifts.

One of the objectives of this project was to examine the feasibility of additional planning efforts which could be undertaken to lessen future skill mismatches.

V. APPROACH TO THE STUDY

Timeframe: This study was conducted by Human Resource Services (HRS) in the period from February through May, 1983.

Scope: As was indicated in Section I, the primary goal of the project was to assess the future workforce skill needs of metropolitan business and industry.

In undertaking this project MATC and HRS established five major objectives. Basically, this study was designed to augment MATC's current economic development activities by:

1.) Emphasizing partnership with Milwaukee business and industry to provide a skilled and productive workforce;

2.) Ensuring students the availability of relevant and saleable job skills;

3.) Increasing impact on the retention and expansion of current business and industry and the attraction of new (preferably high growth) industries to the metropolitan area;

4.) Assessing the need for comprehensive human resource planning as a component of an overall economic development strategy;

5.) Providing data to assist in the educational counseling and career planning of certain targeted groups (minorities, women, displaced homemakers, etc.)

Assumptions: MATC and HRS agreed to a set of assumptions that would be adhered to in conducting this project. These assumptions helped to focus the study within the limitations, both fiscal and timeframe, under which it was to be completed.

The major assumptions are as follows:

1.) That the primary focus of the project would be on new skills growing out of technological change and automation in existing Milwaukee business and industry. Skills involved in advanced or "cutting edge" technologies (e.g., lasers, biogenetics, fiber optics, etc.) would only be considered

within the total context of their possible use in existing industries' manufacturing processes or service delivery.

This decision involved the acceptance of the current business/industry "mix" within the metropolitan area. That mix indicates that a major source of skilled jobs available in the five-to-seven year scope of this project will continue to be in traditional durable goods manufacturing. The skills necessary as those industries move to adopt or to more significantly utilize known technologies (such as CAD/CAM, robotics, CNC, etc.) may significantly alter a number of traditional occupations currently trained for at MATC.

The decision to concentrate on those skill changes acknowledged several major factors. First, that in the short run Milwaukee cannot expect to become another Silicon Valley. Second, availability of skilled technical workforce, albeit a major factor in "high tech" industrial location decisions, is only one of a number of factors considered. Other factors such as labor costs, infrastructure, R & D facilities, business and tax climate also impact significantly on location decisions of such firms. The trade-off became one of researching skills for jobs that do not exist (at least in any significant proportion to total workforce) vs. researching for new skills necessary for jobs in current, but changing, Milwaukee-based business and industry. This project concentrated on the latter.

2.) That closely related to decision #1 was the decision to eliminate potentially high growth business and industries that do currently exist in the metropolitan area but whose total employment is not a significant amount of the current proportional workforce. Such areas as miscellaneous repair services (such as watch and clock repair) are expected to have high growth but the total number of new jobs generated by that growth will be small, given the number of present jobs. The assumption on which this decision was based was that the study should deal with the largest number of job opportunities possible.

3.) That the number of business/industry groupings would be limited (i.e., the choice of essentially nine SIC codes) and the largest possible number of

firms under each of those groupings would be interviewed. It was felt that this decision would offer more valid data than a decision to choose a larger number of groupings and sampling possibly only one firm under each. The decision limits the total number of occupational groups that would be sampled but prevents one firm's skill needs from statistically skewing the data.

4.) That the project was to focus on skilled and technical job groupings. This assumption led to a higher concentration on the manufacturing area than would have been the case if total number of new jobs had been the major selection criterion. Projections clearly indicate a much higher growth rate in the services and trades areas than in most manufacturing industries over the remainder of this decade. However, occupational growth data indicates that the majority of job growth in services and trades category will be in low-skilled, entry level positions which will be only minimally affected by technological change. (See Appendix B for further discussion.) The inclusion of the insurance and banking industries allowed for an assessment of higher level skills necessary in the age of the "electronic office" and the hospital grouping offered an opportunity to review technological change impacts on some of MATC's Health Occupations curriculum.

5.) That for the purposes of this project the methodology of the major source documents was considered neutral. No attempt was made to reconcile the differing economic assumptions used. The HRS sampling matrix simply used the mid-point of the range between the highest and lowest projections appearing in the source reports as the growth rate for selection in the sample. Additionally, only high and medium growth industries were used from the DOD report. Low growth and declining industry codes were not included in the matrix. The issue of skill changes necessary in "aging" industries was addressed by the inclusion of the five slower growth rate durable goods manufacturers identified in Section VI.

6.) That the project would attempt to ignore current and/or already identified future skill shortage areas for which current training exists (albeit a sufficient number of people may not be participa-

ting in that training to meet projected needs.) The project was to focus on skills for which there are no current educational training programs and/or skill areas which will require significant modification in current curriculum due to technology. (See Appendix B for discussion.)

7.) That the project would attempt to identify skills without necessarily directly relating those skills to either a specific occupational group or industry. The focus would be on generic skills that may well cross a number of occupational and industry groups. An attempt would be made to avoid "company specific" skills. This assumption acknowledges that although the project was designed to assess industry skill needs, MATC's obligation to its students requires that they be given the skills that afford them the broadest opportunity for employment in the widest range of firms possible. This assumption, of course, does not preclude the identification and inclusion of a skill area for a technology that exists in only one industry grouping.

VI. OVERVIEW OF METHODOLOGY

Sampling: Starting with the agreed-upon source documents (see Appendix A), HRS constructed a matrix which included six of the ten major SIC categories available. These were Manufacturing; Transportation, Public Utilities and Communications; Wholesale Trade; Retail Trade; Finance, Insurance and Real Estate; and Services. Major categories excluded from the sample were Agriculture etc.; Mining, Construction; and Public Administration.

Those six groupings included a total of 62 two-digit SIC codes. Based on data availability and proportional SMSA employment, 35 of those codes were included in the final sampling matrix used as the basis for selection of the industry groupings to be interviewed.

A number of criteria including projected industry growth rates, SMSA employment data, occupational projections data, assessment of need for technological change and current MATC curriculum were used to reduce the matrix to the nine final groupings from which firms were selected. The breakdown of those nine included 17 three-digit SIC code groupings - eight Durable Goods manufacturers, four Non-Durable Goods manufacturers, four Finance, Insurance groups, and one Services group. The categories were as follows:

A. Durable Goods Manufacturing

- Electric & Electronic Equipment
- Electrical Distributing Equipment
- Engines & Turbines
- Fabricated Metals (Structural)
- General Industrial Machinery
- Metal Forging & Stamping
- Metal Working Machinery
- Miscellaneous Electrical Equipment & Supplies

B. Non-Durable Goods Manufacturing

- Commercial Printing
- Engineering & Scientific Instruments
- Measuring & Controlling Devices
- Miscellaneous Plastics

C. Finance/Insurance

- Banking
- Life Insurance
- Medical/Health Insurance
- Title Insurance

D. Services

- Health/Hospitals

The listing in Durable Goods reflects industries that are predicted to have high growth rates throughout this decade as well as industries that are predicted to have slower growth and recovery. In the latter group (so-called smokestack industries), technological change is expected to impact production methods and processes with resultant changes in worker skills. The Non-Durable Goods manufacturing groups are all considered industries with high growth potential for the 1980's. In Finance/Insurance, the banking and insurance industries were chosen to ascertain the skill impacts of the "electronic office." In the Service category, Health/Hospitals was chosen based on potential for skill changes due to technology.

In the Durable Goods category metal working machinery, electrical industrial apparatus, and miscellaneous electrical equipment are projected to have high growth rates and as a result interviewing was concentrated in those three categories. For sampling purposes, the other five Durable Goods manufacturers which have lower projected growth rates were considered as one grouping. In the Non-Durable Goods area, engineering and scientific instruments and measuring and controlling devices were also treated as one group for firm selection. This was also done with banking and the three insurance categories in the Finance/ Insurance group.

The final selection included the SMSA's two largest (in terms of total workforce) Durable Goods and Non-Durable Goods manufacturers and the largest employer in the Services category. (See Appendix E for firms interviewed under each grouping.)

These SIC code groupings were reviewed and agreed to by MATC and then a non-random selection of firms under each code was selected. An attempt was made to include small, medium and large firms in the interview sample.

Future Skill Needs Assessment

In March an introductory letter explaining the project and MATC's objectives was sent to 55 CEO's, Presidents, and General Managers of area companies by the MATC District Director. A letter was also sent to the Human Resource/Personnel Directors of these companies by the MATC Economic Development Division requesting their cooperation with HRS.

Interviewing: Three major groups of individuals were interviewed during this study:

First, 25 deans, associate deans and instructors at MATC were contacted and interviewed. The instructor interviews (one-half hour to 45 minute duration) concentrated on curriculum changes over the past five years, feedback from employers and students on adequacy of current curriculum, and planned or projected curriculum changes over the next several years.

Second, 39 Personnel/Human Resource V-P's or Directors were interviewed. These 45 minute to one hour structured-format interviews covered a wide range of topics including the company's job description and job analysis format, ongoing human resource planning efforts, current training needs and relationships with MATC. During this interview a list of specific job titles for which MATC graduates would normally be hired was developed. The last task during the interview was to identify the individuals within the company with whom the technical interviews regarding changing skills would be conducted.

An attempt was made to identify individuals who were close enough to day-to-day operations to have a working knowledge of the actual functions of the jobs to be discussed, while at the same time who were knowledgeable of the firm's planned or projected changes in equipment, product lines, or manufacturing processes.

Third, technical skill interviews were conducted with some 115 individuals in the 39 firms sampled. When possible, the interviews were set up in a group format (ranging from two to five individuals). Individual interviews were conducted when scheduling problems arose. Fifteen of the 115 were conducted by telephone.

Specific technical job titles in each individual's area of responsibility were discussed. Information was elicited regarding recent changes in the knowledges and skills necessary to adequately perform these jobs (par-

ticularly knowledge and skill changes due to technology); regarding existing skill and training deficiencies in current employees and/or recent hirees; and regarding new knowledges and skills that would be critical to successful job performance in the future.

Wherever possible during the interview, an attempt was made to differentiate the knowledges, skills or abilities into four categories of importance from the companies' point of view:

1.) Those that would be useful or a definite plus, but would not be the basis of a final hiring decision.

2.) Those that were seen as essential in an applicant to be seriously considered for employment.

3.) Those that were critical to an individual's performance day one on the job - without it an individual would very probably not be hired.

4.) Those which would be required of any applicant hired into that position.

Individuals were also asked to identify, where possible, new jobs that might be created because of technological or process changes and jobs that would not exist in their operation in five years.

A representative listing of the titles of individuals participating in these interviews is given in Appendix C. Appendix D lists a sampling of specific job titles discussed during the interviews. See Appendix E for a listing of the 39 companies in which interviewing was conducted.

VII. SUMMARY OF FINDINGS

These findings illustrate the perceptions and opinions of the 154 individuals in 39 metropolitan area companies that were interviewed during this project. As evidenced in Appendix C, these individuals represent a broad range of executive, managerial and technical positions in both line and staff functions within the companies sampled. The 39 companies represent nine distinct business and industry groupings with extremely diverse product lines and service orientations. The company sizes ranged from 35 to 4500 employees.

The comments in the following sections indicate the "best guess" by these individuals as to what their companies' critical skill needs will be over the remainder of this decade.

A major concern surfaced in the comments made during a number of the interviews conducted. It was particularly evident in the durable goods manufacturing area which represented over 50% of the sample. The concern basically included three major themes:

1.) A frustration that technology is changing so rapidly that it is extremely difficult to assess needs one year from now, let alone five years into the future.

2.) A sense of urgency about identifying needed future skills. The majority of the individuals interviewed acknowledged that without significant upgrading of the skills in both their present and future workforce, their companies can not stay competitive.

3.) A strong realization that capital equipment decisions concerning the acquisition of technology for production processes are intimately tied to the ability to upgrade the skills of workers who must use that technology.

Perhaps these themes can best be summed up in the following comments:

> "We're still training today's people for yesterday's jobs - but we don't yet know what tomorrow's will be."

Future Skill Needs Assessment - Findings

> "We need a massive retraining effort on our shop floor if we expect to be in business by 1990."
>
> "I can't justify a $3 million capital equipment purchase without the people who can make it pay off."

The range in the size and the nature of the companies interviewed created a broad continuum in terms of future skill needs assessment. Because the primary objective of this report was to provide information to MATC for use in determining educational policy and curriculum modifications, the decision was made to array the findings around current MATC curriculum areas.

This study could not begin to sample the full range of either MATC programs or jobs for which post secondary technical education and training is or will be needed. However, in the nine business/industry groupings that were sampled, 20 MATC curriculum areas were touched on. They were:

1.) Mechanical Technology-Design
2.) Mechanical Drafting
3.) Tool and Die Making
4.) Machine Shop (Machinist)
5.) N.C. Operator/Programmer
6.) Electromechanical Technology
7.) Technical Engineering
    a.) Electrical
    b.) Mechanical
8.) Industrial Engineering Technician
9.) Metallurgy
10.) Business Data Processing
11.) Accounting
12.) Business Administration
    a.) Banking and Finance
    b.) Management
13.) Printing and Publishing - Operations
14.) Biomedical Electronics
15.) Radiological Technology
16.) Respiratory Therapy
17.) Operating Room Assistant
18.) Nursing
    a.) Registered
    b.) Practical
19.) Industrial Electronics
20.) Hydraulics - Pneumatics

Future Skill Needs Assessment - Findings

In conducting this project HRS made no attempt to evaluate current MATC curriculum vis a vis the future skill needs expressed during the interviews. It is clear that a number of the "future" skills appearing within the comments in the following sections are currently included in certain MATC programs. Realistically, a number of the firms interviewed have not hired new graduates in most technical areas within the last two years or more. In some instances their perceptions are based on individuals who graduated quite some time ago. The point, however, is that these companies quite clearly will need people with many of these skills when they start to hire again. As a result, such comments were not edited because it was felt that they may provide MATC useful information on two crucial points:

1.) The level of business and industry's knowledge of recent MATC efforts to update its curriculum; and

2.) The determination of the size of the budget allocation to certain programs and curriculum areas for which business and industry will have increased needs in the near future.

Several additional comments are necessary at this point regarding these findings:

First, during the course of the interviews, a number of comments were made concerning MATC programs and curriculum. On the durable goods manufacturing side, extremely favorable comments were made regarding MATC's initiatives in CAD/CAM and interactive computer graphics, as well as its NC program and its plans for a flexible manufacturing lab. Equally favorable comments were received on the non-manufacturing side, particularly concerning the Word Processing program. Both groups also had favorable comments about various on-site special courses that had been conducted by MATC in recent years.

However, this project was not designed to give feedback to MATC about what it was doing "right" but rather to assess selected business and industry regarding changes which they considered critical in their efforts to adjust to the rapid technological growth of the 1980's. As a result, the summary sections only reflect responses to questions regarding perceptions of current curriculum deficiencies and comments on anticipated skill changes.

Readers and users of this report should take that fact into consideration when reviewing the comments which

appear in Sections A through J.

Second, the comments under each curriculum area constitute a representative cross section of the knowledges, skills and/or abilities which were cited in the interviews. As indicated in the Methodology section (see p. 18), wherever possible an attempt was made to differentiate between knowledges, skills or abilities that were useful, essential, critical, or required.

Third, comments regarding skill deficiencies of current workers and specific comments regarding perceived problems with current MATC programs were included when it was felt that such comments would be helpful in curriculum updating.

Fourth, repeatedly during the interviews, companies stressed that the skills they were highlighting required that the individual have an adequate basic educational foundation. Most of the comments revealed that the firms were not satisfied with the level of basic educational skills of individuals they interview. A number of individuals stressed the need to "beef up" high school core curricula with computer science; keyboard / typing skills (not programming per se); applied science (physics, chemistry); and higher level math courses. Logic and applied statistics were often mentioned as suggested core high school curriculum.

Organization of Findings Sections: The headings at the top of each section represent MATC curriculum areas. For simplicity of presentation, data on certain related curriculum areas were sometimes aggregated into a single section.

Immediately following the curriculum, there appears a Summary of Key Trends. This section summarizes skills that were identified by the companies as most important for their operations five years from now. The skills that appear in the Summary represent the skills which emerged most often throughout the interviews dealing with that curriculum area.

The quotes appearing in the sections were excerpted from the interviews. In some instances they may be representative of remarks made by several individuals during different interviews. The underlined portions of the quotes represent skill areas which were repeatedly stressed by many different firms.

Some sections include a General Comments listing containing supplementary comments.

At the end of each section is a Sample of Specific Job Titles which were discussed with the companies. An aggregated listing of job titles for all curriculum areas appears in Appendix D.

Future Skill Needs Assessment - Findings

Section A

MECHANICAL DRAFTING

TECHNICAL ENGINEERING

ELECTRICAL

MECHANICAL

MECHANICAL TECHNOLOGY - DESIGN

Summary of Key Trends:

1.) Plastics, both design and technology, appears as an essential emerging skill in the design functions of a number of companies interviewed.

2.) CAD, computer graphics, developmental programming skills and microprocessor knowledge will be required for employment in five years or less with the majority of employers interviewed.

3.) The traditional division between electrical and mechanical design functions is blurring. An individual with knowledge in only one area will become less useful over the next five years to a number of the employers sampled.

4.) Hard copy design functions will virtually disappear, in a number of companies interviewed, over the next five to seven years (if not sooner).

MECHANICAL DRAFTING

- An understanding of plastics design characteristics will be essential in less than five years;

- Successful drafters must have better conceptualization of machining and manufacturing processes;

Future Skill Needs Assessment - Findings

- By 1988 only 10 to 15% of our designs will be hard copy - won't hire without CAD exposure;
- CAD/computer graphics a must;
- CAD will be required;
- We are unclear as to how to bring our current drafters up to speed on the dimensional and visualization skills necessary for CAD;
- Tracers and detailers are no longer needed; there will be no place for high school level drafters in our workforce in five years;
- We can't afford CAD. I'll have a continued need for drafters in this shop.

ENGINEERING TECH - ELECTRICAL

- Knowledge of solid state - critical; software development and application will be required;
- Extensive knowledge of printed circuit boards, passive components and breadboarding;
- Electronic packaging will be the key to a successful candidate;
- CAD knowledge will be a requirement for this position;
- Knowledge of process controls will be a requirement in all new hirees;
- Board layout is important today - five years from now anyone without that knowledge will not be hired by our lab;
- Programming skills and knowledge of development systems will be the first thing we look for in an interview;
- Knowledge of more sophisticated instrumentation up to and including logic analyzers will be crucial;

Future Skill Needs Assessment - Findings

- Microprocessors are an essential tool for our techs, it will become more and more critical;

- Mechanical/Electrical/Electronic interface is becoming predominant in our product lines. Even if someone is primarily electrical they need some degree of mechanical design capability to do the job we need done.

ENGINEERING TECH - MECHANICAL

- Some electronics knowledge will be required of all our future mechanical techs:

- Keyboarding skills are already critical today;

- Knowledge of capabilities of microprocessor based programmable controllers will make the hiring decision between three equal candidates;

- Developmental programming, and extensive knowledge of microprocessors will be required;

- Over the years this has been a kind of trial and error person for us; in the future we must have people with more academic knowledge in machining capability and metallurgy;

- MATC curriculum should include more emphasis on cutting technology (i.e., ceramics, coated carbides);

- At least an introductory course in finite element analysis will be required for this job - not more than three years in the future;

- Plastics knowledge (physical properties and analysis techniques) will be extremely useful. It would afford the tech much greater mobility in our operation;

- Computer knowledge and computer graphics exposure will be required - in less than five years;

- CAD is already damn near a necessity. Two years from now I wouldn't hire a mechanical tech without those skills;

Future Skill Needs Assessment - Findings

- I'd like to see much more emphasis on tool design - five years from now it will probably be required in all our techs;

- What can you (MATC) do about teaching your engineering techs about manufacturability?

- More and more force calculations, feeds and speeds etc. are being done by the computer. Our current techs need better skills on how to interpret and analyze computer data and CRT graphics outputs;

- Although electronics will be necessary for our mechanical techs, basic mechanical knowledge and tool use will remain a key component of the job. A number of us have been telling MATC for years that their people are weak in "hands on" tool use when they get to us;

- We need good technical writing skills in these positions. They must have the ability to organize disparate data with clarity. For us that's been a traditional weakness in MATC grads.

MECHANICAL TECHNOLOGY - DESIGN

- Plastics knowledge is now essential in our design groups - need to understand physical properties and mold design techniques;

- Finite element analysis is already crucial; I'd definitely want related course work in the next designer I hire;

- If I needed to hire a designer tomorrow I'd let the position sit vacant if I couldn't find one with a working knowledge of CAD/CAM;

- MATC cannot put a heavy enough emphasis on geometric tolerancing in all of its design programs;

Future Skill Needs Assessment - Findings

- We will need all of our designers to understand electronic packaging - regardless of their specialty. If we had to, we'd hire someone today without it (and train them ourselves) but a year from now I'd go through 20 applicants to find that skill;

- If the CAD software continues to develop at its present rate, some of our design areas won't need our CAD techs in five years - the engineers will be fighting to get to the terminals;

General Comments on this Job Series:

- In five years time, our entire drafting and design function will be CAD. There will be a few jobs that will initially be too complex for CAD or simply too routine to be cost effective;

- We just don't need "pretty picture people" - the day of the high school level drafting tech is rapidly coming to an end;

- No one in these job classes will be hired by us (or our major competitors) in five years without extensive computer skills and knowledge;

- We're currently developing CAD training programs for all our drafting/design people;

- Even though much of the traditional detail work of drafting will soon be extinct, no one should touch a terminal until they have adequate knowledge and skills in basic drafting and design theory. However, MATC should be eliminating or deemphasizing courses in detailing and mechanical drawing in order to make room for CAD. I'd like to see a minimum of three CAD courses in any of MATC's drafting, design and Engineering Tech programs;

- Plastics knowledge (i.e., shrinks, characteristics, strengths) becoming more crucial daily;

- We currently have a number of drafters on layoff; if their reinstatement rights expire prior to callback, we would not rehire them. We need people who can use a CAD system.

Future Skill Needs Assessment - Findings

Sample of Specific Job Titles:

Detailer; Layout Detailer; Designer; Detail Drafter; Product Design Drafter; Tool Designer; CAD Tech; Tool Engineering Tech; Mechanical Design Tech; Mechanical Tech; Test Tech.

Future Skill Needs Assessment - Findings

Section B

TOOL AND DIE MAKER

MACHINE SHOP (APPRENTICE MACHINIST)

NC OPERATOR / PROGRAMMER

Summary of Key Trends:

1.) Required skills and knowledges for tool and die makers and machinists will include: computer skills - both programming and understanding of systems; ability to handle microprocessors; working knowledge of CNC and EDM equipment; ability to interpret computer generated data in a number of companies.

2.) There appear to be present and growing needs for tool and die makers with knowledge of plastics and plastics molding skills.

3.) High speed machining will require more academic preparation for tool and die makers in metallurgy and probably thermodynamics.

4.) Their positioning in the CAD/CAM stream will require skilled machinists to have a much greater grasp of manufacturing process and a concept of systems interface.

5.) There will be continued fairly rapid growth in the demand for people with NC programming skills. However, the tendency is clearly to build those skills into existing jobs which already interface with the machinery.

TOOL AND DIE MAKER

- The tool room will contain much more automated equipment in the next few years. Knowledge of and ability to work with EDM, CNC, and microprocessors will be required of our tool and die people;

*NC = Numerical Control
CNC = Computerized Numerical Control

Future Skill Needs Assessment - Findings

- Knowledge of plastics and plastics molding will be essential to us in three years or less;

- We have present needs for and anticipate a growing need for tool and die people with plastics and plastics molding skills;

- As the tool room changes tool and die makers must have higher level and more sophisticated tool design skills. It is a critical skill and will certainly be a major consideration in any new tool and die makers,

- Computer courses, including microprocessors and programming should become a part of the apprenticeship curriculum, as soon as possible. Anyone coming out of that program in the next several years should at least get short courses in programming and NC,

- We expect to spin off our tool room. It's too expensive an operation for us;

- Our next move after NC and CNC will be to high speed machining. Tool and die makers will need more metallurgical skills, and preferably thermodynamics. The ability to deal with finer tolerances and smaller tooling will be required;

- Tool and die makers are being forced to deal with more and more computer generated data - our present ones don't handle it very well;

- Little change will occur in our tool room in the next 10 years;

- Our tool and die makers will be part of a CAD/CAM stream - we will be looking for higher and higher levels of decision-making and analytical skill; understanding of how function interfaces with a complex data base if they are to effectively perform in the future tool room environment (and it's not that future!);

- Any new tool and die maker we hire today should have NC knowledge.

Future Skill Needs Assessment - Findings

MACHINIST

- Programming and knowledge of microprocessors will be required of all our skilled machinists in five years - and sooner if we can get them;

- NC and CNC familiarity is a must for any new hiree;

- Must be able to do floor programming and edit programs;

- How much metric conversion is being taught down there? (MATC);

- All our skilled machinists will need to understand the marriage between the computer and machine tooling. That takes a lot more than "a black box" mentality about computer systems;

- Simply programming NC is not a big deal - we can teach that skill relatively quickly. What is critical, as we move into CAM, is some systems understanding;

- Skilled machinists must have up to date cutting tool technology knowledge - that requires short courses which have to be available somewhere in the educational system;

- If we were hiring apprentice machinists again (which we hope we will someday!), we have definite courses we would like to see them get on the academic side:
  (1) NC - more than just an intro course; also needs CNC
  (2) a strong applied statistics course
  (3) a manufacturing process course that includes exposure to robotics, PCs, FMS and MRP
  (4) a course in programming for micros

  Those courses reflect skills and knowledges that we will require from any new skilled machinist we're hiring not more than three years in the future.

Future Skill Needs Assessment - Findings

NC OPERATOR / PROGRAMMER

- Within several years, five at the outside, there probably won't be a distinct NC Programmer job. Once tool and die people, skilled machinists and I.E.'s (Industrial Engineering Techs) have picked up those skills, through courses like the one that MATC offers, the programming will be folded into their jobs;

- We don't have a need for a great number of people as NC Programmers - we currently have two who work with our engineering staff and more than handle our current and anticipated needs;

- Within the not too distant future, an NC Operator will be considered a semi-skilled job. The Operator will do nothing more than push a button.

General Comments on this Job Series:

- Over the next five years, we will need fewer, but more highly skilled tool and die makers. Those who don't get additional training will probably be utilized as tool room machinists;

  We will also need fewer machinists. However, with additional education, their mechanical and shop background would provide an excellent basis for them to move into a mechanical design, maintenance mechanic, or industrial engineering slot. We will need more of these positions over the next few years;

- Die sink and jig borer positions will become much less skilled because of NC (i.e., button pushers).

Sample of Specific Job Titles:

Tool and Die Maker; Tool Room Machinist; Mold Maker; Machinist; NC Programmer; Machine Operator-NC.

Future Skill Needs Assessment - Findings

Section C

ELECTROMECHANICAL TECHNOLOGY / HYDRAULICS - PNEUMATICS

Explanatory Note:

The comments appearing in this section are derived from interviews which involved such titles as Maintenance Mechanic, Maintenance Repairer, etc. In many industries there traditionally have been separate job classifications for Electrical repair and Mechanical repair positions. The comments in this section clearly indicate a strong desire and intent on the part of industry to blend those functions into one job.

The majority of individuals interviewed about these positions were convinced that in five years none of the key equipment in their plants could be handled by an individual with only one of these skill areas.

Because the current MATC Electromechanical Program contains the type of the blending that industry was seeking it was selected as the appropriate curriculum area under which to array these findings.

Summary of Key Trends:

1.) Individuals with combined electrical/electronic - mechanical skills will be required more and more.

2.) Knowledge of computers, programming skills and microprocessor exposure are already essential and will be required in five years by many companies.

3.) Knowledge of hydraulics and servo mechanisms will be required in firms using robotics.

4.) Trouble shooting, problem solving and logic skills were sighted again and again. Companies said they would require those skills except for the fact that if they did, they'd have to leave most of their positions vacant.

Future Skill Needs Assessment - Findings

ELECTROMECHANICAL TECHNOLOGY / HYDRAULICS - PNEUMATICS

- We must have individuals who can deal with electrical/electronic - mechanical interface problems. We need it now - we can't wait five years for this type of technician;

- In three years - tops - I wouldn't hire a maintenance repairer for the plant that didn't have computer skills. They must have programming skills to be able to trouble shoot;

- Five years from now we wouldn't want to let anyone who doesn't understand microprocessors near much of our equipment - they don't need to deal with chip replacement but certainly would have to be able to trouble shoot and replace a board, for instance;

- Hydraulics knowledge and the ability to work with programmable servo machanisms and servo positioning systems will be a requirement.

- In five years we will require essentially four skill areas in all our machine repairers:

  1.) computer knowledge:

  - will need keyboarding and minimal programming for diagnostics

  - should be able to handle board swapping

  2.) electronics:

  - primary concern will be solid state but must be able to deal with digital read-outs - analog to digital conversion knowledge would be a real plus - instrumentation only up to level of continuity testers and volt/amp meters

  3.) hydraulics:

  - key will be knowledge of function of servo mechanisms

Future Skill Needs Assessment - Findings

4.) mechanical:

- basics - fits, bearings, spindles, ball screws vs. slides

If at all possible we would not hire someone who didn't have some level of ability in all four;

- More and more digital electronics knowledges and skills are required - will be a must in five years;
- Our key in this is a practical vs an analytical type. Should trouble shoot from angle of what's wrong not why it stopped. The key is get it going again;
- I know the essential qualities we need but I don't know what course you should put them in - trouble shooting and problem solving;
- If I were structuring a curriculum for what we need in a maintenance repairer, I'd make at least 25% of it hands-on lab work - trouble shooting problems, using diagnostic equipment, etc.;
- I sometimes feel MATC overstresses how to use equipment and shorts people on logic and problem solving. They have to be exposed to it.

Sample of Specific Job Titles:

Machine Repairman; Maintenance Mechanic; Maintenance Repairer.

Future Skill Needs Assessment - Findings

Section D

INDUSTRIAL ENGINEERING

Summary of Key Trends:

1.) Computers are now the primary tool of IE's. They will be required to have good programming/software skills and systems analysis and interface skills.

2.) Knowledge of robots - fundamentals as well as manufacturing and systems applications will be required of an IE going into a firm using or expecting to acquire robot technology.

3.) Capital acquistion feasibility studies will require broad manufacturing process knowledge as well as extensive knowledge of NC,CNC, DNC.

4.) Many companies expressed a growing need for what was most often called a technical generalist - someone with some fundamental technical knowledge in a number of disciplines who could be used as a kind of manufacturing process facilitator and trouble shooter.

5.) Key skills discussed again and again relative to this position were innovation, flexibility, and ability to adjust quickly to change.

INDUSTRIAL ENGINEERING

- Computer knowledge will be required - programming skills, data readout and interpretation, systems ability and understanding are critical;

- Robots, Robots, Robots - the IE will be the key technical person in robot use and planning- will have to understand fundamentals of robotics - manufacturing, applications of robotics and systems applications of robots;

Future Skill Needs Assessment - Findings

- More and more sophisticated statistical analysis tools are essential in an IE tech;
- This person will have to have knowledges in electrical/electronic, pneumatics, hydraulics and mechanical;
- This is a key position as we become more automated - the IE will have a big role to play in the design of our CAM system.
- In two or three years I will need to be hiring people as IE's who can integrate numerous microprocessor units into a system;
- Feasibility studies becoming much more complex- IE is going to have to sleep, eat and breathe with robots, CNC, DNC;
- Tooling, pricing and materials knowledge are more and more important for us - this person really should have strong background in tooling and at least the fundamentals of tool design and tool pathing;
- With the amount of capital equipment acquisition that we'll be doing to automate our systems over the next few years, feasibility studies will be one of the most critical functions in our plant operations;
- I care less about work measurement from this position - require much more knowledge of manufacturing and machine processes;
- In five years the most sought after IE types will be those who have good skills with microprocessors and software manipulation;
- The curriculum for this position should be heavy in systems analysis, product flow analysis and sequence of feature creation;
- The next ones we hire will have to be knowledgeable of MRP and MRPII;
- It will be required that this individual have good knowledge of automation engineering, production flow engineering and systems engineering;

Future Skill Needs Assessment - Findings

- The Japanese see this kind of tech (i.e., a good technical generalist) as the key to making flexible manufacturing work;
- We will have more and more use for individuals that have good skills in process planning (i.e., operations sequencing, tool use);
- The key ingredients in this position are a good mix of knowledge in quality engineering, manufacturing process, scheduling and statistics and computers;
- Anyone we would hire today into such a position would have to have a good knowledge of robotics;
- On top of it all the person in this position must have excellent "people" and communication skills - they will have to interact with many different work groups and teams. Won't be able to function without those skills;
- I don't know how you go about teaching it but problem solving skills and innovative thinking are the most critical ability in this position. I'll hire as many people with those skills that you can send me;
- (MATC): Teach your students that to be successful technologists in the manufacturing environment of the 80's - they've got to be risk takers - they have to be able and willing to be flexible and adjust quickly to change;
- Anyone in school for these positions now should be coming out with a working knowledge of AMPS.

Sample of Specific Job Titles:

Process Tech; Manufacturing Process Tech; Q.C. Tech; Industrial Engineering Tech; Manufacturing Engineer; Production Tech.

Future Skill Needs Assessment - Findings

Section E

METALLURGY

Summary of Key Trends:

1.) Plastics and composite materials knowledge is becoming essential to met techs in many companies interviewed. Most saw it as a **required** knowledge in three to five years.

2.) The ability to interpret and analyze computer generated test data is already essential. That ability along with developmental programming skills was seen as required in five years.

METALLURGY

- Knowledge of plastics will become a key part of this job;

- In three to five years we won't have a "met tech" per se - it will be a materials tech (i.e., will need to deal as much with plastics, fiber glass, etc. as they will metal);

- This is a relatively stable skill job for us - plastics knowledge is becoming more essential;

- We'll be experimenting with lighter metals in product lines - some academic exposure to "exotics" would be useful;

- Most of our current met techs need training in plastics and fiber reinforced composite materials (need to know physical properties, analysis techniques and testing techniques for both). We'll certainly require that knowledge in any new hirees;

- As with all other techs these folks have to be more sophisticated in computers - currently the need is for ability to interpret and analyze computer generated data. I would guess that **five** years from now we'll require programming skill

Future Skill Needs Assessment - Findings

related to developing software for test programs;

- The plastics and composite materials requires them to know how to use microtomes and transmission microscopes.

Sample of Specific Job Titles:

Met Tech; Chem/Met Tech; Metals Lab Assistant.

Future Skill Needs Assessment -- Findings

Section F

BUSINESS DATA PROCESSING

Explanatory Note:

The data in this section is arrayed in two separate categories: 1.) Business (non-manufacturing) and 2.) Manufacturing. Although the basic skills required are the same, some unique applications of those skills seemed to lend themselves to the separation.

The critical skills common to both are highlighted in the Key Trends section.

Summary of Key Trends:

1.) Knowledge of and ability to use structured programming and analysis techniques will be required in both manufacturing and non-manfacturing environment.

2.) Systems analysis, a broader knowledge of operating systems and data base management were considered critical by both. Clearly systems analysis skills will be required of entry level programmers five years from now.

3.) Programming of graphics and related statistical programming would be considered a critical skill in future programmers.

4.) Both groups felt MATC should somewhat de-emphasize specific languages training in favor of more analytical and analysis skills.

5.) Good knowledge of microprocessors and especially their integration into an overall operating system will become more and more critical for programmers in both environments.

6.) Exposure to 4th generation languages will be required.

Future Skill Needs Assessment - Findings

BUSINESS DATA PROCESSING - BUSINESS

- We'll need programmers with better ability to program graphics;
- Future programmers need much heavier academic exposure on structured methodologies of analysis and programming;
- MATC puts too much emphasis on specific languages - their people need more training in conceptualizing problems and solutions;
- Over the remainder of this decade there will be a greatly diminished need for even entry level programmers without some systems analysis training;
- If two year computer grads are going to compete in this they will need to demonstrate systems capabilities and an understanding of computer capabilities (i.e., how to use and apply it to various problems);
- Micro knowledge will be required;
- Specific languages (RPG, COBAL, etc.) will become much less important.
- Generally it will be harder and harder for a two year program to supply what we need;
- Ability to program graphics and accompanying statistical analysis and forms design are already essential - will become critical or required within several years;
- Programmers will have to become more "user" oriented because of decentralization. They'll be dealing directly with a number of different departments in the company assisting with micro programming - that means excellent communication skills will be critical;
- We will be requiring a higher level of sophistication relative to overall business processes;
- MATC should de-emphasize specific languages and hit harder on systems analysis, business courses and data base management skills.

Future Skill Needs Assessment - Findings

- Our programmers need better ability to determine the appropriate uses of RJE vs interactive vs on-line vs time sharing for decentralized users;

- We need people who can work with users and decide the right format and distribution for their problem;

- Programmers will need ever increasing ability to apply business principles to systems design and analysis - critical;

- COBAL and Basic are still important today. However programmers coming out in five years will need exposure to 4th generation languages - NOMAD, FOCUS, RAMIS, NATURAL and others;

- Current MATC's (and many other school's) curriculum is weak in program maintenance skills. They should be able to use other's codes and documentation to enhance existing programs. This is a critical skill in our operations and will become more and more important;

- Knowledge of on-line vs batch processing will be required.

Future Skill Needs Assessment - Findings

BUSINESS DATA PROCESSING - MANUFACTURING

- We need programmers that understand systems applications and manufacturing process and flow;
- Understanding of structured programming will be required;
- We want to see some exposure to Assembler, Pascal and FORTRAN, but really don't need super proficiency in any language - other skills are much more critical;
- Currently too much emphasis on languages and hardware skills in MATC grads - knowledge of system becoming more and more critical in all programmers - it will become a requirement;
- Coursework on manufacturing process should be required of any programmer who is planning to seek a job in a manufacturing environment;
- We will have greater needs for developmental programmers who can handle both software and firmware;
- Current programmer grads just have not been taught to be problem solvers;
- In five years any programmer I hire will need good knowledge of specification languages, conversational programming and computer graphics;
- My future programmers will be required to have a broader knowledge of operating systems - I don't really care that much what language they know;
- Our software people must have a better understanding of the manufacturing process - that is critical today - with more automation it will be required;
- All future programmers will be required to deal with the applications and integration of microprocessors in a total system.

Future Skill Needs Assessment - Findings

Sample of Specific Job Titles:

Computer Operator; Computer Programmer Trainee; Computer Programmer; Programmer Analyst; Data Processing Specialist; Developmental Programmer.

Future Skill Needs Assessment - Findings

Section G

BUSINESS ADMINISTRATION

ACCOUNTING
BANKING AND FINANCE
MANAGEMENT

Explanatory Note:

These three programs were discussed primarily in the Banking and Insurance firms interviewed. However, a separate section concerning the Management program in Manufacturing is included.

Because of the similarity between the comments relating to two-year Business graduates, they have been arrayed in a single category.

Summary of Key Trends:

1.) For any two-year Business graduate expecting to be hired into a technical or administrative position, very strong computer skills, including systems analysis and data base management, will be required. Programming will be essential to critical.

2.) Overall, it will be progressively more difficult for two-year graduates to compete against BBA's and CPA's in many of the companies interviewed. In today's job market companies have had an opportunity to hire four-year graduates into positions in which two-year graduates have traditionally been slotted. Many individuals interviewed felt that even as the labor market loosened, that trend would continue.

3.) As large business offices, such as were sampled in this survey, move into the age of the electronic office, there will be a blending of the roles of two-year Business graduates, regardless of their academic specialty. They will have an important role to play in the integration of the automated office.

Future Skill Needs Assessment - Findings

4.) It appears that in large automated business offices, the two-year graduate will take on a role similar to I.E.'s in a flexible manufacturing environment - as a work process, work flow, people/machine facilitator technician.

BUSINESS ADMINISTRATION - ACCOUNTING, ETC.

- Anyone in that type of program today should be heavily exposed to computer and information management systems;
- To the extent we'll be hiring people with two year degrees, we will be looking for and requiring computer skills, and strong statistical and data analysis ability;
- The ability to help us with worker-machine interface will be considered critical in that level job;
- We'll need people at that level with an understanding of records management. In five or six years they will be required to have knowledge of CAR (computer assisted retrieval) and COM (computer output microfilm);
- We just don't get much reponse from two-year grads when we advertise;
- We will continue to use two-year grads - however their major entry into our system will be through the customer services area and they will need computer skills and a good ability to understand a complex data base;
- As automation eliminates more and more low level clerical positions we would look to two-year business and accounting folks to fill the higher level and more complex clerical/support positions that will exist;
- We have need for two-year accounting people as account clerks, auditors and trust analysts but they must have data processing knowledge and skills - it will be required;

Future Skill Needs Assessment - Findings

- I would think that to be hired in five years, a two-year grad will have to demonstrate knowledge of a number of disciplines that will be essential to the integrated electronic office:
  - data processing
  - word processing
  - records management;
- Computer skills and systems analysis capability will be required;
- We'll have needs at that tech/administration level for people able to work with AOS/MIS interface;
- Microfiche, micrographics and computer graphics for business applications will undoubtedly be required of people coming into our organization with two-year Business degrees;
- All our business accounting people - two or four year - will be required to work on the development and implementation of integrated systems touching on all staff functions;
- Four-year grads will push out two-year and the two-year will push down to eliminate high school grads from our workforce;
- They will be required to work with application and graphic generators;
- Their computer work - five years from now and probably sooner - should include 4th generation languages - NOMAD, etc.;
- Forms design and development of administrative and manual procedures will be the key things we'll be looking for in two-year business people;
- They will be part of work stations in a complex information system and will require computer skills. Systems understanding will be more important than programming. Programming would help their job mobility within the organization;
- Workflow analysis and people machine interface will be essential;
- Ability to work with and apply micros will be required.

Future Skill Needs Assessment - Findings

MANAGEMENT - MANUFACTURING

- The role of the foreman will become more important in the flexible work team approach;
- Instead of growing our foreman in-house, as we've traditionally done, we'll probably be looking outside for a person with some business training and supervisory skills;
- As foremen, we need people with business backgrounds, understanding of manufacturing process and good people skills;
- Our foremen will become people/machine facilitators whereas IE's will be machine/people facilitators;
- A two-year business grad with some manufacturing process coursework and computer skills would be a prime candidate for a foreman position;
- We'll need foremen with more business knowledge, more technical skills and computer knowledge.

Sample of Specific Job Titles:

Account Clerk; Claims Adjuster; Senior Payroll Clerk; Administrative Technician/Analyst; Premium Analyst; Statistical Analyst; Trust Analyst; Foreman.

Future Skill Needs Assessment - Findings

Section H

PRINTING AND PUBLISHING - OPERATIONS

Summary of Key Trends:

- Sample size too small to make determination of key trends vis a vis skills. Electronic printing systems will continue to grow but their total impact on skills and knowledge was unclear.

PRINTING AND PUBLISHING

- Press operators will become less and less skilled - much more of the machine process is computer-controlled;

- More camera and graphics work is computerized - the system's microprocessor and built-in densitometer assure results;

- Operators need better ability to trouble shoot plate/press problems such as premature image wear, scumming, tinting, slur, etc.;

- People will have to be familiar with System Brunner and tolerance frame charts;

  (Ed. Note: System Brunner is a recently developed color control system based on the idea that color picture tones are affected more by variations in half tone dot size than by variations in the solid density of each color; i.e., ink film thickness.)

- Heat-set web offset knowledge is critical for our press people;

- We'll have more and more needs for people with a combination of printing knowledge and business knowledge for customer service functions;

- Right now we hire either four-year Graphics Arts Management people or high school grads

Future Skill Needs Assessment - Findings

who will, over time, work their way from the binding into a pressman position;

- Our internal graphics and print department may well be extinct in five years. With the software capability to do graphics, exploded views, etc., the combination of word processing tied to a laser printer will make it unnecessary;

- Anyone coming into a print shop five years from now will need to know how to handle laser scanners, microwave transmission, microprocessors, and computer controlled markup.

Sample of Specific Job Titles:

Pressman, Platemaker, Chromalin Operator, Printer.

Future Skill Needs Assessment - Findings

Section I

HEALTH OCCUPATIONS

BIOMEDICAL ELECTRONICS
RADIOLOGICAL TECHNOLOGY
RESPIRATORY THERAPY
OPERATING ROOM ASSISTANT
NURSING
- REGISTERED
- PRACTICAL

Explanatory Note:

The sample size in this grouping was too small to justify key trends except as noted in the Nursing section.

BIOMEDICAL ELECTRONICS

- I need now and will require in future Bio Med personnel good skills in analog development and analog circuitry;
- They **should** have some fundamental coursework in analog design - it will be critical in a hiring decision;
- Will require knowledge of high voltage circuits;
- Knowledge of physiology and anatomy are required more and more of **these** techs;
- Our people need microprocessor knowledge - board replacement ability and programming skills for trouble shooting will be required;
- Better communication and human relations skills are critical. They will be required to work in teams with nurses and physicians.

Future Skill Needs Assessment - Findings

RADIOLOGICAL TECHNOLOGY

- Five years from now it will be essential for any newly hired Rad Tech to have knowledge of
  1.) C.T. scanning,
  2.) NMR,
  3.) digital vascular radiology, and
  4.) ultrasound.
  Specialization in one or more of these will be taken care of in the hospital's OJT efforts, but any person coming out of school must have had some level of training in each;

- Understanding of computer systems will be required of all new Rad Techs;

- There are some 12 hospital-based Rad programs in this area, all of which have been cutting back on enrollments recently - why is MATC increasing enrollment in this program?

- MATC grads can't currently compete well because they don't get enough lab exposure - this will be even more critical in the future;

- We aren't looking for CT or ultrasound specialists coming out of a two-year program, but they must have some knowledge of the theory and techniques - it will be required;

- MATC would do better having people specialize during their externship rather than rotate as they do now;

- Computer functions, not programming but rather applications in a dedicated radiological usage will be required;

- Knowledge of digital vascular radiology will be required;

- Computer fundamentals will be a requirement;

- Anyone in this position should have a good background in applied statistics - this has become essential.

Future Skill Needs Assessment - Findings

RESPIRATORY THERAPY

- MATC concentrates too much on the technical aspects of this job in their current program - they need more of a clinical training;
- Current MATC grads come out understanding the machinery but don't know how to analyze and use the data the machines give them;
- Cost containment efforts may have major impacts on this position - five years from now we'll probably have R.N.'s doing many things Respiratory Techs do today;
- The knowledges that are becoming more critical in this field are
  1.) metabolic analysis, and
  2.) pulmonary rehabilitation;
- We will be looking for much more critical care knowledge - for instance, skills in volume ventilator therapy will be required;
- These individuals will need a better understanding of pulmonary disease and of pharmacology;
- Understanding of transcutaneous values and high frequency ventilation will be required;
- A clinical and team approach to therapy will be essential in this position.

OPERATING ROOM ASSISTANT

- This is not a position which will change significantly over the next five years;
- These people must be trained better to understand the delicacy and cost of the instrumentation they're dealing with.

Future Skill Needs Assessment - Findings

NURSING - REGISTERED / PRACTICAL

Explanatory Note:

The comments concerning these two positions are summarized in the two following Key Trends.

Summary of Key Trends:

1.) It will become progressively more difficult for two-year R.N.'s to compete against three- and four-year grads in the next few years.

2.) LPN's will play a much smaller role or be phased out entirely of the acute care hospital environment.

Sample of Specific Job Titles:

Biomedical Technician; Radiology Technician; Respiratory Technician; Operating Room Technician; Registered Nurse; Licensed Practical Nurse.

Future Skill Needs Assessment - Findings

Section J

INDUSTRIAL ELECTRONICS

Explanatory Note:

In 1982 a group of local high tech electronics companies made extensive recommendations to both MATC and WCTI regarding their skill needs in the area of Electronics Technicians. Some companies that are participating in this High Tech Training Council were included in the interview sample for this study. However, only minimal information regarding Electronics Tech was requested from those firms on the assumption that such information had already been included in the High Tech Council's recommendations.

The comments summarized below are based primarily on information gathered from firms that had not participated in the recommendations made earlier.

Summary of Key Trends:

1.) Both microprocessor capability and knowledge of solid state logic were stressed repeatedly as requirements for future electronics techs.

2.) Electronic design and packaging skills will be a major factor in hiring techs in most of these companies.

3.) The criticality of analog vs digital varies greatly from company to company. Basically some level of knowledge of both is a requirement for all future electronics techs.

4.) There was also a split on the need for programming skills. However, the trend is clearly to much better **software** skills in electronics techs. In some companies it will be an absolute requirement in five years.

5.) Technical writing skills were stressed as critical by all the companies.

Future Skill Needs Assessment - Findings

INDUSTRIAL ELECTRONICS

- Knowledge of solid state logic and microprocessor capability will be required of any lab tech hired five years from now;

- Within the next five years, all of our electronics techs have to develop in-depth knowledge of IC's and will be required to work with multilayered boards and printed circuit boards layout;

- In five years we won't be hiring anyone without hands-on exposure to ATE (automated test equipment);

- There's no question that in five years we'll be looking for knowledge of PLA (programmable logic arrays) in new techs;

- Future techs will be required to have a better understanding of discrete components, high speed switching circuits and support chips;

- Even in our current recruiting, we're looking for good programming skills and exposure to higher level language. By five years from now a key hiring criteria will be good software skills - the ability to massage data;

- Logic, signature and spectrum analyzers are already tools of the trade for these guys - certainly wouldn't hire anyone in the future without good knowledge of these instruments;

- All else being equal, in three to five years the person who has good knowledge of electronic design and packaging is the one we'll hire first.

- MATC electronics students need much more exposure to computer simulation for troubleshooting;

- Present MATC grads are weak in analog. They need it to deal with signal inputs and outputs as well as power supplies;

- We will be looking for more and more mechanical assembly skills in our lab techs - specialized electromechanical assembly is replacing mass production assembly;

Future Skill Needs Assessment - Findings

- Wire wrapping and bread boarding will be critical;

- Pattern generation and pattern recognition are becoming more crucial;

- Any electronics lab tech we hire in five years must be able to deal with complex computer based systems, needs excellent software development skills and a greater appreciation of and ability to use software;

- Lab techs hired in future need more knowledge of data compression techniques;

- We really don't need lab techs with programming skills;

- If someone is going to work with op amps they must understand analog circuitry;

- LSI will become more crucial over the next five years;

- In digital both bi-polar and MOS logic types are becoming crucial. These knowledges will be required of most of our lab techs in five years;

- MATC students concentrate too much on instrumentation - they need less of that and a better understanding of what a computer can do in the lab and how to use it most effectively;

- Digital knowledge - I don't care about analog;

- In five years an electronics tech without good microprocessor knowledge , particularly using it in troubleshooting, just won't be useful to us - and they won't get hired;

- Not satisfied with the quality of technical writing skills in MATC techs. Their communication skills generally inadequate;

- To show you how fast this field is changing - we currently have people in our lab with good backgrounds in AC/DC and analog/digital circuitry. I tell them repeatedly that unless they upgrade their current skills there will not be a job for them here in five years. The problem is I don't think they believe me.

Future Skill Needs Assessment - Findings

General Comments on this Job Series:

- We would like to see MATC turn more minorities and women out of their technician programs - we need help with our affirmative action efforts in those types of jobs.

Sample of Specific Job Titles:

Lab Technician; Electronics Technician; Test Technician.

VIII. CONCLUSION AND RECOMMENDATIONS

Structural unemployment arises from an imbalance between worker skills and the needs of employers. Traditionally, such "skills mismatches" have been caused by changes in the composition of the area's economy.

A shift in the "mix" of Southeastern Wisconsin's economy is unquestionably taking place: however adding the issue of technology and automation to the equation has significantly exacerbated that problem.

The Future Skill Needs Assessment project was undertaken to respond to the concerns of this growing "skills mismatch" between the metropolitan workforce and local business and industry. The project's primary focus was on skills emerging out of technological change.

This study was essentially the first step in an effort by MATC to:

A.) Obtain information as to how it could more effectively meet the needs of area employers;

B.) Fulfill its mandate to the citizens of the area to provide opportunities to gain current, marketable and competitive job skills; and

C.) Assess its potential role in long term human resource development planning as part of an overall economic development effort for the continued viability and economic growth of the metropolitan area.

The following pages delineate the preliminary conclusions and recommendations concerning these points.

Future Skill Needs Assessment

A.) EMPLOYER NEEDS: First, it is clear from the findings which appear in Section VII that firms are not requesting MATC to add significant new curriculum to help meet their anticipated skill needs. The predominant issue was not one of "new skills" or "new occupations" but rather the focus was on increasing the number of available people with certain "already known" knowledges, skills and abilities for jobs which already exist but are dramatically changing due to technology.

The decision as to how it can best supply the quantities of people that will be needed with those sets of skill mixes is obviously the next step required in MATC's planning efforts. It is a complex problem which will most likely include a variety of training modes and involve on-site plant retraining for currently employed workers, increasing the size of current degree and diploma programs, and structuring additional short courses and/or certificate programs.

Significant business community involvement in that planning effort would be essential.

Second, in some ways the business and industry representatives who participated in this study were asking for certain "new curriculum" at MATC. Not in the sense of adding additional courses - but rather in significantly realigning some current curricula.

If the skill combinations envisioned in the Findings sections are to be realized, some courses similar to those currently required of a Business Data Processing degree candidate would become requirements in Welding, Tool and Die, Machine Shop and many other programs. Plastics technology would become required coursework in Metallurgy, Technical Engineering and Drafting, among others. The listing of course areas to be broadened and/or restructured is significant.

This study made no attempt to pass judgment on the reasonableness or advisability of such curriculum shifts. Counterarguments about the appropriateness of such modifications can be and no doubt would be raised if MATC chose to undertake such an effort. The decision to array the Findings data in the manner it was presented in Section VII was an attempt to give MATC the most direct feedback possible from the

companies interviewed. Obviously, this data is only one of many factors that would be used in any significant educational policy decisions by MATC.

B.) MANDATE TO CITIZENS: The amount of positive feedback received concerning MATC during this study indicates that many of its current graduates are gaining marketable and competitive job skills. The question of how MATC can continue to achieve this success in technical areas which are changing daily has no easy answer. Based on some of the findings reported, two-year graduates will have more and more difficulty competing in some job markets. In some programs students will need skills which they are not currently learning if they expect to find employment.

In 1977 a study was prepared for a group of twelve major Milwaukee area companies by Professor Jon Udell of the University of Wisconsin Business School. That study dealt with various facets of the skilled labor force issue including both supply and education of skilled workers.

The authors of that report indicated that:

> It was striking how little agreement there was on exactly what the schools should be offering students. Some companies wanted schools to provide more technical skills, others felt "thinking skills" were more important. There were companies calling for narrower, more specialized training and just as many asking that programs be broadened to include more diversity of training.
>
> (Emphasis added.)

Six years later, at least with the 39 companies included in this survey, a more consistent attitude is clearly prevalent in the comments of the business community.

1.) The issue of "thinking skills" as evidenced by problem solving ability, logical analysis and reasoning skills, and the ability to understand and interact in complex systems was stressed as absolutely essential by all the companies interviewed.

2.) Unquestionably one of the major requirements which companies ask of their technical people today is that they be much more "technical generalists" than highly specialized, narrowly-trained individuals who fit into singular types

> of jobs. The only job category sampled where this was not the case was Electronics Technicians. Companies clearly acknowledged that in this field even a highly concentrated two-year program was hard pressed to cover the basic technical skills they considered critical.

The Udell study also noted that:

> One of the few things companies seemed to agree upon was that schools needed to do more to acquaint students with the reality of factory life and instill the work ethic in them.
>
> (Emphasis added.)

Those issues did not surface in the interviews conducted for this assessment, although it can be assumed that the "work ethic" was implicit as a fundamental, without which the technical skills being discussed would be irrelevant.

The two strongest issues of this nature that did surface in this set of interviews were:

1.) That schools must do a much better job preparing their students to understand business and manufacturing systems and processes so that they have some understanding of the overall environment in which they will be functioning; and

2.) That schools must instill an ability to deal with change and a lifetime learning ethic into their students. One of the most often repeated comments throughout these interviews was that "people coming out of school today in almost all technical fields must be made to understand that without ongoing education the skills they have when they graduate will be outdated in five years."

Perhaps one of the most effective ways in which MATC can continue to meet its goal to provide students with competitive job skills is through instilling that understanding and philosophy into all of its graduates.

Future Skill Needs Assessment

There is a range of institutional responses which MATC could consider in addressing these issues:

First, the creation of additional certificate and diploma programs in both emerging technological skill areas and traditional technical areas. This would allow either past or current associate degree students the opportunity to broaden their specialized technical training. It would also provide an opportunity for non-technical individuals who need some level of technological literacy or training to stay productive as their current jobs are impacted by technology.

Second, taking steps to increase the number and/or size of classes available relevant to skills that were identified as critical or required emerging skills (i.e., plastics, systems analysis, microprocessors, manufacturing and business processes, etc.). Pending decisions on modifications of either general or technical core curriculum and/or the creation of additional certificate/diploma programs, these courses would be immediately available to students in any program on an elective basis.

In addition, ensuring that MATC students are informed of the importance that business and industry are placing on a broader range of technical skills and counseling students to use elective credits to gain technical knowledge outside their field of concentration.

These steps would require modifying any current policies or procedures that hinder students' access to courses outside their division.

Third, the evaluation of the associate degree general core curriculum to determine whether, for example, a three-credit computer science course should be built into that core. This would allow for more advanced coursework to be included in various technical core curricula. It would also be appropriate to review the current focus of the Business and Industrial Relations courses contained in the general education core. It is certainly feasible that business and industry's concerns about student understanding of complex organizational environments could be addressed within the context of those courses.

Fourth, the revision of current policies and procedures regarding the Cooperative Education program. That program provides an excellent source of feedback concerning changing skill needs. Although the majority of the larger companies indicated that their co-op efforts were limited to four year degree students, a number of the small and medium size firms expressed interest in and willingness to co-op with MATC students.

The Cooperative Education program now requires that a placement be for two semesters and that it be a paid experience. Federal guidelines regarding those two issues have recently been modified. In the interests of increasing student exposure to the business community and the feedback loop on needed skills, MATC may wish to modify those policies to allow for shorter duration, non-paid experiences, particularly in small and medium size companies.

Fifth, adopting a more integrated and aggressive policy regarding corporate equipment donations. A review of recent corporate contributions indicates that roughly 75% of current equipment donations come from companies outside the metropolitan Milwaukee area. MATC must make the implicit message behind that figure clear to the Milwaukee business community. That is, if business and industry require the kinds of exposures and skill development they are requesting, then they must be more willing to aid MATC in acquiring "state of the art" equipment and instrumentation.

Responsibilities for soliciting equipment contributions are currently fragmented throughout various MATC divisions and the MATC Foundation. The sparsity of local corporate donations would indicate that a more coordinated and intensive approach will be required.

C.) HUMAN RESOURCE DEVELOPMENT PLANNING: To say that there is a need for better human resource development planning efforts given the current and projected levels of structural unemployment in this community is to beg the obvious. It is questionable whether any community can tolerate the high economic and social costs over an extended period. Clearly Milwaukee is not unique in experiencing an economic trauma that is, at least in part, a product of this nations's (and the world's) transition from the Industrial age to the Information age.

However, the area of "human capital" planning is a highly complex and volatile public policy issue. It is one that does not lend itself to "quick fix" solutions. By the same token, sophisticated planning models have also failed to successfully address the issue.

The issue, simply stated, is that until an ongoing, serious and successful cooperative effort between the Milwaukee educational and business communities is established, this community will undoubtedly continue to experience serious labor market dysfunction.

This is not to denigrate the many cooperative efforts which have been attempted or are currently in place. However, given the accelerated pace and magnitude of the changes occurring in business and industry, these efforts will not be adequate to provide lead time for the responses that will be necessary.

MATC, as the largest vocational technical institution in the area, would be a logical focal point for attempts at coordinated planning.

If MATC chose to undertake such an attempt, there are a number of issues which could be addressed:

First, the retraining of currently unemployed workers who have been displaced by technology. For instance, industry representatives who participated in this study indicated that machine operators and related workers now being displaced by plant automation have a skill base which, given appropriate supplementary education and training, could render them valuable and productive workers in the future.

Future Skill Needs Assessment

However, there must be planning as to what training is most needed. Without some assessment of need, it is quite likely that overtraining for high-profile positions (such as robotics technicians) would occur.

In addition, these workers need information about the options and opportunities available to them. This is certainly key information which MATC could coordinate in cooperation with the business community and other appropriate groups or agencies. The MATC Division of Economic Development has recently created an Economic Development Advisory Committee to assist the Division in its planning efforts. It would be possible for that committee to quickly assemble a technical advisory group to prioritize the occupational areas for which displaced workers could be best targeted.

Second, better utilization of its current curriculum advisory committees. The business and industry representatives on those committies can be an excellent source of crucial data about ongoing and future job skill changes. However, to make that data useful in the formulation of overall educational policy, it needs to be collected and analyzed in a coordinated planning system. Such a system should also allow MATC to have better data on the future demand for certain skill areas so adjustments can be made to program size.

Third, the coordination of course scheduling to ensure that courses which address critical future skill needs are given priority in time slots which make them available to currently employed workers who need skill upgrading. In addition, attempting to make more short courses dealing with these skills available in late afternoon and weekend time slots.

Fourth, exploring greater use of on-site or in-plant training models and the development of an informational and marketing function for that type of training.

IX. CONCLUDING IMPRESSION

Business and manufacturing methods and procedures are being radically altered by the automation and technological change that is occurring at an ever accelerating rate. We are bombarded daily with a plethora of "high tech" buzz words being generated out of both the "electronic office" and the "factory of the future."

But behind all the glitter of Micros, Chips, CAD and CAIR, what clearly emerges is a fundamental conceptual shift in the organization of work processes in business and industry. Accompanying this shift, as was evidenced during the course of this project, is a dramatic change in organizational expectations concerning workers.

Key descriptive words and phrases emerged again and again during interviewing - "risk-taker," "innovator," "flexibility," "problem solver," "adaptability to change," "trouble shooter" . . . .

If the number of times a skill area was mentioned is to be correlated to its criticality, then those skills or abilities are the ones these companies desire most in their future technical workforce.

The message seems to be that these skills and abilities will be required for individuals to successfully function in the organizational environments which are expected to emerge. In both the manufacturing and non-manufacturing environment, those skills will more often be used in work teams intended to respond rapidly to shifts in design, engineering, production, marketing, sales, consumer demand, or technology.

This "future skill" is obviously a key issue for business and industry. However, the skills and abilities encompassed in the innovator, risk taker, problem solver.... are not ones that translate easily into a curriculum development plan. No one interviewed was able to readily offer a course outline for Innovation 101!

If MATC is to fulfill its dual mandate to the business community and to its students, it will be required to work actively with business and industry to develop tnis concept into a reality for future MATC graduates.

Furthermore, to make the kinds of transitions alluded to in this study, many companies will be forced to seriously examine certain of their traditional views concerning the scope of the private sector role in employee training and skill development. The creation of a workforce with the kinds and mixes of skills identified in this study cannot be achieved without increasingly active commitment and assistance from business and industry. This will be necessary on issues related both to future employees and to upgrading knowledges and skills of current workers.

The process involved in implementing changes will at times result in conflicts between the specific technical needs of the business community and the broader implications of public educational policy. The integral tie between business and industry's "human capital" investment and their long-term economic viability means they must also be willing to apply "innovative" solutions to resolve these issues.

APPENDIX A: SOURCE DOCUMENTS

MAJOR SOURCE DOCUMENTS:

Lerman, Philip E. Employment Projections: 1980-1990, Comparative Analysis. Milwaukee: University of Wisconsin System, Employment and Training Institute, June 1982.

Plantes, Dr. Kay. Wisconsin Manufacturing: Charting a Course for Renewed Vitality. A report presented in five volumes: Executive Summary, Background Reviews, Past and Present, Future, A Development Strategy for the 1980's. Madison: Department of Development, July 1982.

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Future Skill Needs Assessment

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APPENDIX B: SERVICES / TRADE OCCUPATIONAL GROUPS

1.) Service Area Growth (See Assumption #4, p. 13.)

A number of discussions concerning this assumption were held between MATC and HRS.

The decision regarding concentration on manufacturing revolved around two major factors:

a.) As noted by DOD (see Wisconsin Manufacturing - Background, p. 4.), Milwaukee area service growth is tied directly to its manufacturing base. It is not a regional economic center such as Atlanta or Chicago. Therefore, it is critical to the area's overall economic viability to help maintain its basic industrial vitality.

b.) According to occupational growth projections available, the five largest growth occupations (in raw number growth) in the service sector through 1990 will be:

(1) Janitors
(2) Nurses' Aids and Orderlies
(3) Sale Clerks
(4) Cashiers
(5) General Office Clerks

Other high growth (in terms of total jobs) occupations are expected to be Waiters and Waitresses, Food Preparation and Fast Food Service Workers, and Kitchen Helpers.

Obviously, none of these occupations are ones for which post secondary technical training is typically required.

2.) Current Skill Shortages (See Assumption #6, pp. 13-14.)

Certain occupations which have been identified as projected shortage areas for 1990 have been included in this study. (Refer to Metropolitan Association of Commerce's 1981 Project Skills Report.) However, this

study concentrated on "future" skill needs and changing skills within such occupations. This list would include such positions as : Tool and Die Maker, Machine Repairer, Machinist, Computer Operator/Programmer and Draftsman.

APPENDIX C: TITLES OF INTERVIEW PARTICIPANTS

Following is a representative listing of interviewees:

Chief Engineer
Chief Engineer, Electrical Design
Chief of Operating Services
Chief of Operations
Coordinator, Training and Development
Data Processing Manager
Director, Human Resource Administration
Director, Management Development
Director, Training and Development
Director of Accounting
Director of ATC and QC
Director of Biomedical Engineering
Director of Computer Systems
Director of Engineering
Director of Engineering Evaluation
Director of Manufacturing
Director of Manufacturing Engineering
Director of Personnel
Director of Radiology
Director of Respiratory Therapy
Director of Technical Services
District Staff Manager
Drafting Supervisor
Engineering Manager - Manufacturing and Industrial Engineering
Employment Manager
General Manager
General Supervisor
General Supervisor - System Manufacturing
Industrial Relations Coordinator
Manufacturing Engineer
Manufacturing Manager
Manager, ATC
Manager, CAD/CAM
Manager, Data Processing
Manager, D.P. Training
Manager, Design Engineering
Manager, Employment
Manager, Engineering Evaluation
Manager, Engineering Services
Manager, Human Resources
Manager, Industrial Engineering Production
Manager, Manufacturing Engineering

Future Skill Needs Assessment

Manager of Design Engineering
Manager of Manufacturing
Manager of Quality Assurance
Manager, Personnel and Human Relations
Personnel Assistant
Personnel Director
Personnel Manager
Plant Engineer
Plant Manager
Plant Manager - Manufacturing
Press Room Supervisor
Production Center Manager
R & D Director
Senior Vice President Human Resources
Superintendant, Maintenance
Superintendant, Manufacturing Engineer
Supervisor, Data Processing
Supervisor of R & D Engineering Lab
System Manufacturer
Technical Director
Technical Superintendant
Vice President - Director of Engineering
Vice President - Manufacturing
Vice President - Human Resources
Vice President - Information Services

APPENDIX D: TECHNICAL JOB TITLES SAMPLED

Account Clerk
Biomedical Technician
CAD Technician
Chromalin Operator
Claims Adjuster
Clerical Supervisor
Computer Operator
Computer Programmer
Computer Technician
Customer Service Technician
Designer
Detail Drafter
Developmental Programmer
Drafter
Electronics Repairer
Electronics Technician
Engineering Assistant
Engineering Tech - Components
Foreman
Industrial Engineer
In-Mold Designer
Inventory Analyst
Lab Technician - Chem/Met
Lab Tech - Electrical
Layout Detailer
Licensed Practical Nurse
Machinery Repairer
Machinist
Maintenance Mechanic
Manufacturing Engineer
Manufacturing Process Engineer
Mechanical Designer
Mechanical Design Technician
Mechanical Drafter
Mechanical Technician
Metallurgy Technician
Model Maker
Operating Room Technician
Platemaker
Premium Analyst
Process Development Technician
Process Technician
Product Drafter
Programmer/Analyst
Programmer Trainee

Future Skill Needs Assessment

Pressman
Printer
Q.C. Technician
Radiology Technician
Registered Nurse
Respiratory Technician
Senior Payroll Clerk
Statistical Analyst
Test Technician
Tool and Die Maker
Tool Engineering Technician
Tooling Technician
Tool Room Machinist
Trust Analyst
Underwriter Trainee

APPENDIX E: COMPANIES SAMPLED *

I. Durable Goods

A. Metal Working Machinery

- Carlson Tool
- Kearney & Trecker
- Stanek Tool

B. Electric and Electronic Equipment

- Allen Bradley
- ASEA
- Eaton Corporation
- G.E. Medical Systems
- Marquette Electronics
- Pillar Corporation
- **Square D**

C. Scientific and Controlling Instruments

- Astronautics
- Badger Meter
- Erie Manufacturing
- Johnson Controls
- Realist

II. Non-Durable Goods

A. Printing and Publishing

- Arandell-Schmidt
- Cuneo Press
- Krueger Printing

B. Miscellaneous Plastics

- Gossen Tool
- Plastronics
- Sta-Rite Industries

Future Skill Needs Assessment

III. Finance/Insurance

A. Banking

- First Bank of Milwaukee
- First Wisconsin
- Marshall & Ilsley

B. Life/Health/Title

- Blue Cross/Blue Shield
- MGIC Corporation
- Northwestern Mutual Life
- NN Corporation
- Time Insurance

IV. Services

Health/Hospital

- Froedert
- St. Joseph's
- St. Luke's
- St. Mary's

V. Durable Goods (Changing)

- Falk
- Harnischfeger
- Ladish
- Perfex
- Rexnord

VI. Other

- Wisconsin Telephone

* Many firms have multiple SIC designations. The code under which a firm appears in this listing may not be its primary SIC code.

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